

**Motion** ▪ *Laboratory Investigation*

## Measuring Speed

### Pre-Lab Discussion

Perhaps you've heard about the race between the tortoise and the hare. The hare was a fast runner but kept taking breaks because it was so sure of winning. The tortoise could only walk but never took a break. The hare lost the race.

These two racers demonstrate the difference between speed at one particular instant and average speed. To find a person's speed, you need an accurate measurement of the distance he or she travels and how long it takes the person to cover the distance.

In this investigation, you will design and use a plan to find the average speed of a pedestrian.

1. What is the formula used to calculate average speed?  
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2. If you calculated the average speed of a runner in a marathon, would the runner be moving at that speed at every point in the race? Give a reason for your answer.  
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\_\_\_\_\_  
\_\_\_\_\_

### Problem

How can you find the average speed of a pedestrian?

### Possible Materials *(per group)*

tape measure or meterstick

masking tape

3 stopwatches



**Safety** Review the safety guidelines in the front of your lab book.

Don't get in the way of the people whose speed you are measuring. Don't create hazards in the walkway.

**Motion** ▪ *Laboratory Investigation***Measuring Speed** *(continued)***Procedure**

1. Read through the entire lab now.
2. Develop a procedure to find out how fast pedestrians move. Consider the following variables and questions as you develop your procedure.
  - Choose a place that gets a lot of pedestrian traffic. It should have room for you to work without getting in the subjects' way.
  - How long should the course be?
  - How will you mark the beginning and end of the course?
  - When does a subject officially enter the course and leave it?
  - How will you get accurate beginning and ending times for the course?
  - How many people will you need to do the timing?
  - Include a way to check whether the pedestrian's rate is variable or constant. For example, you could have timers at the quarter mark, halfway point, and at the three-quarters mark. A fourth person could signal all the timers to begin timing, and each would stop their stopwatch as the pedestrian passed by.

Write your procedure on a separate sheet of paper.

3. Decide what data you will need to collect. You should gather enough data to be able to show whether the subject speeds up or slows down. Time at least 5 subjects. Adjust the Data Table on the next page so that you can use it with your procedure. You may want to add columns and headings.
4. After the teacher has approved your plan and data table, go ahead with the experiment. Practice your timing technique before trying to record data. You may need to adjust the length of the course.
5. After you collect your data, answer the questions in Observations.

**Observations**

1. Which pedestrian had the fastest average speed over the entire course?  
What was it?  
\_\_\_\_\_
2. Which pedestrian had the slowest average speed over the entire course?  
What was it?  
\_\_\_\_\_

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**Data Table**

Course Length: \_\_\_\_\_

Subject		Total Time (s)	Average Speed (m/s)

**Analyze and Conclude**

1. Did any of the pedestrians speed up while walking the course? How do you know?

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2. Did any of the pedestrians slow down while walking the course? How do you know?

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**Measuring Speed** *(continued)*

**Critical Thinking and Applications**

1. How accurate do you think the measured times are? Suggest a method that would allow you to get more accurate results in this experiment.

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2. Would the results of your investigation have been different if you had timed vehicles on a street rather than people walking? Would it have been easier or more difficult to get accurate results? Give a reason for your answer.

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3. If you were going to repeat the investigation using vehicles, would you be more likely to get accurate results with a longer course or a shorter course? Give a reason for your answer.

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**More to Explore**

Do you know what your average walking speed is? It probably varies, depending on circumstances, such as whether you're late or early for school. How could you use your walking speed to measure distance? On another sheet of paper, write a procedure you would follow to answer this question. Include a way to check the accuracy of your measurements. Have the teacher approve your procedure before you carry out the investigation. How could you improve the accuracy of your measurements?